

PROGRESSIONS: PEER-LED TEAM LEARNING

NSF AWARDS DISSEMINATION GRANT FOR WORKSHOP MODEL

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The National Science Foundation's Division of Undergraduate Education National Dissemination Program has awarded a three-year, multi-million dollar grant for the proposal, *Peer-Led Team Learning: National Dissemination by the Workshop Project*.

The Workshop Project's model of peer-led team learning (PLTL) in science and mathematics courses at the undergraduate level uses students as peer-leaders. Students who have performed well in a course are recruited to facilitate problem-solving workshops that are part of a course's requirements. Each peer-leader is assigned six to eight students and meets with them weekly to guide and engage them in scientific debate and discussion regarding the fundamental concepts and applications of the course material.

Peer-leaders are trained in several teaching techniques and group dynamics. They work closely with faculty members and prepare by discussing the workshop content with the faculty in weekly meetings. The success of the model has been established by a five-year evaluation study showing that major outcomes of the model are greater student motivation, involvement, and improved performance in courses.

Dissemination efforts for the Workshop Project will include regional workshops and short courses where participants engage in workshop activities under the direction of experienced peer-leaders, project faculty, and learning specialists. Follow-up discussions with peer-leaders give participants an opportunity to witness student enthusiasm for the

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DISSEMINATION STRATEGIES FORMULATED AT ROCKY MOUNTAIN CONFERENCE

The first Rocky Mountain Conference on Peer-Led Team Learning, held August 7-11, 1999 at the University of Montana in Missoula was attended by 37 participants from campuses across the U.S. to discuss key dissemination, leadership, and scholarship issues related to peer-led team learning. Conference organizers Mark Cracolice (The University of Montana), Jack Kampmeier (University of Rochester), and David Gosser (City College of New York) designed an intensive three-day schedule.

Presentations on the model began with an examination of concerns raised by formative evaluations of past dissemination efforts, led by Pratibha Varma-Nelson

of St. Xavier University. Mark Cracolice presented a history of influential curriculum designs in science education, concluding with social constructivism, a theory of learning that underlies the workshop model. Joe Griswold of City College of New York discussed the importance of benchmarking in the dissemination effort, and he illustrated how a benchmarking process has led to curriculum improvement in Anatomy and Physiology teaching at City College. The Benchmarks Model has been adopted by the national Human Anatomy and Physiology Society (HAPS) for their core curriculum project, and by several academic units at City College.

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PROJECT NOTES

Peer-Led Team Learning is "a well established, documented model with sufficient flexibility to be utilized in multiple circumstances"

It is an exciting time for the peer-led team learning model. In less than a decade of development it has been recognized as (in the words of one NSF reviewer) "a well established, documented model with sufficient flexibility to be utilized in multiple circumstances" and "has the potential to have broad, substantive impact" not only in chemistry, where it was initially developed, but also in physics, biology, mathematics and, well, anywhere instructors are searching for an alternative to the one-dimensional and limiting "lecture-only" format.

As we initiate this phase of the Workshop Project and its expanded level of commitment, it is appropriate to reflect on what are the unique characteristics that bring such enthusiastic responses from students, faculty, and reviewers alike.

1) *The technical answer:* Critical Components form the basis for certain tested core convictions. Our project evaluation is based upon a careful examination of the presence of these components. Continuously examined and dynamic, they provide opportunity for feedback and refinement of the PLTL model.

The Critical Components are:

? The PLTL Workshop is integral to the

course, coordinated with the other elements;
? The faculty teaching the courses are closely involved with the Workshops and the Workshop leaders;

? The Workshop leaders are students who have successfully completed the course. They are well trained and closely supervised, with attention to knowledge of the Workshop problems, teaching/learning strategies, and leadership skills for small groups;

? The Workshop materials are challenging at an appropriate level, and integrated with the other course components, intended to encourage active learning and to work well in collaborative learning groups;

? The organizational arrangements including the size of the group, space, time, noise level, teaching resources, etc. promote learning;

? The institution, at the department level and beyond, encourages innovative teaching and provides sufficient logistical and financial support.

What the PLTL model offers is a well-defined instructional format that is consistent with many approaches to content and style.

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PLTL Workshop Project Coordination

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model. Additional dissemination activities will include presentations at educational conferences and seminars, publication of Project research data online and in print, through journals, newsletters, and workshop guides.

To assist faculty to utilize this tested model, the Project will also provide financial support for the initial implementation of peer-led team learning.

National support for the PLTL model has been garnered through the participation of seven colleges and universities acting as regional centers. These include the City College of New York (New York, NY), Portland State University (Portland, OR), Prince George's

Community College (Largo, MD), Saint Xavier University (Chicago, IL), the University of Miami (Coral Gables, FL), the University of Montana (Missoula, MT), and the University of Rochester (Rochester, NY).

The Principal Investigator, David K. Gosser Jr., is at City College of New York, City University of New York, where the model was initially developed for teaching Chemistry courses. The model is currently being expanded to include courses in Biology, Physics, Mathematics, and Geosciences. The Workshop Project's web site is <http://www.sci.cuny.edu/~chemwksp>.

WORKSHOP LEADERS' PERSPECTIVES:
SHELA ROTE, UNIVERSITY OF MIAMI (OH) AND
KEVIN HONG, UNIVERSITY OF KENTUCKY

Shela Rote is a senior at the University of Miami, Ohio, with a double major in pre-med and sociology. This term is her second time as a workshop leader. She was interviewed in September 1999 by Leo Gafney.

Leo: *Tell me a little about the workshop arrangements--the group size, how long you meet, and things like that.*

Shela: Last year there were four in my group. We met in a study room in the library. This year I have eight and we meet in an actual classroom. So that's a little different. It's actually better. Since there are more, there is a little more accountability. With four, if one is missing it's like you're just having this little chat. But I think eight is about the limit.

Leo: *What kind of training do the leaders have at the start of the year?*

Shela: We are taking a course through the Education Department. Last year we did a similar course for tutoring. We had an orientation and met once a week for two hours and discussed things that work and don't work and how to get people motivated. This year we will meet on Saturday and discuss things like study skills and how to help students be more effective in learning chemistry.

Leo: *What kinds of materials do you use?*

Shela: I'm a little different, because I really get into this. I'll bring a model kit, or cut out different things from construction paper. We do skits. Like I'll get them (students) to pretend they're molecules. It's really silly, but they get into it, and they're never going to forget how hydrogen bonding works. We're learning stoichiometry this week and I'm bringing different kinds of candy to work on different kinds of groups. Anything to try to make it more like real life.

Leo: *What got you going this way?*

Shela: Chemistry was really hard for me as a high school student and I did pretty poorly. So it is amazing that I have the major that I do. But I was frustrated and didn't enjoy it at all. So I came to college with a really bad attitude, and didn't really want to take the class that was required to go to medical school. But I was taking it and Dr. Sarquis started doing all these experiments in class and so that kind of got me started thinking, 'wow this is real; this is cool.' So I started looking for ways to make it interesting. And then I started to really like it. I did a total 180 and began to love it. Then I would look for any way to make it more fun.

Leo: *So the workshop was a great opportunity.*

Shela: Yes it really was. And I think maybe I

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WORKSHOP PROJECT WEB SITE ADDS INTERACTIVE DATABASE
<http://www.sci.ccny.cuny.edu/~chemwksp>

The Workshop Project Web site has a new look. Redesigned by Project Assistants Xiaomei Li and Hong Yuan, it provides up-to-date news and practical information about peer-led team learning. An interactive "Ask Jack" column is featured, where faculty new to the Workshop Model can pose questions and receive expert guidance from Project Co-PI, Jack Kampmeier. General questions will form the basis for a Faculty Forum. There will also be a Student Leader Forum to aid in leading workshops.

A major component of the site is the

new "Communication Center." A comprehensive database of contact information for project participants is maintained, as well as project-related presentations, and peer-led team learning implementations. The database will aid in providing up to date information for all participants, and will be utilized as the project's data collection site for regular reports to the National Science Foundation. Workshop Project Associate program faculty can log-in and input information about a presentation, a course, or add to the Project Contact Database. Check it out and send in your comments!

WORKSHOP LEADERS' PERSPECTIVES

“Real education is not about listening to a big lecture. It's about discussing things with just anyone.”

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am a little more compassionate than someone for whom chemistry comes easily. I know how hard it is. I think that a big part of the workshop is the discussion, like, 'Boy I had to work four hours trying to figure this out.' Because people think they are alone. So it is important to get students to understand the importance of group work.

Leo: *Any other benefits to students?*

Shela: One of the things that they get really frustrated about, but that is a big part of the program, is that there aren't any answers. It really is like real life. If any of these people are planning to do research, or even just work in a real job--there aren't any answers.

Leo: *Do you meet regularly with Dr. Sarquis?*

Shela: He meets with us once a week and he tries to let us go through it as a group, but he is right there in the room with us and he will say, "This is how you might want to approach this," to be sure we are on the right track.

Leo: *Do the students get the sense that the professor wants them to be involved and that the workshops are important?*

Shela: Definitely. I walked in this year and they had the self-test started. They were already excited and motivated, and felt like the workshop was important. It's because he built it up to be important. A lot of things that I was prepared to tell them, I didn't really have to say. Dr. Sarquis had already explained it. They wanted to stay late to do some problems.

Leo: *How about yourself? What benefits do you feel you have gained from the workshops?*

Shela: Originally I got involved because I am planning to teach later on in my career, and I wanted to find out something about what works and what doesn't in discussions and things like that.

Leo: *Do you feel you have achieved some of that?*

Shela: I think I have. I'm a big organizer, but I have found that sometimes I have to realize that the way the group turns the discussion is probably better than what I had planned. I really listen to them. And the more I listen to why they don't understand something the easier it is for me to make the next workshop more applicable to their needs and where they are coming from.

Leo: *It sounds as if there are a lot of benefits to stu-*

dents beyond learning chemistry, such as learning to listen.

Shela: Yes, it is preparing them for their future education. Real education is not about listening to a big lecture. It's about discussing things with just anyone. It makes me hopeful that they will get some discussions going on their own. I told them on the first day, "This group is not just for meeting from two to four on Tuesday." I gave them all each other's phone numbers and told them to call each other . . . their professor is not the only person they can learn from.

Kevin Hong, a biology major, is a peer leader for General Chemistry at the University of Kentucky. This is the fourth time he has been a workshop leader. Leo Gafney interviewed him in September 1999.

Leo: *Could you tell me a little bit about the organizational setup of workshops--the size of groups, how often they meet, and the like.*

Kevin: Usually there are seven to nine students in a group. This year Dr. Wilson has been able to expand the program to a lot more students than previously. We are spread out all over the campus, at a lot of different times. We have a lot of flexibility. Some of the leaders like to meet outside; some at the Students' Center; anything to make it more interesting. We usually meet for two hours.

Leo: *How many students are there in the program?*

Kevin: About 300, and about 30 leaders. This is the first time that Dr. Wilson told students that if they sign up for a particular section of general chemistry, they have to sign up for Chem Excel (the name of the workshop program at UK). Before it was optional.

Leo: *And do you have introductory training sessions for the leaders?*

Kevin: Yes, Dr. Wilson usually holds some sort of orientation. When I began it was easier because there were only 10 leaders. He could give individual attention to each leader. Now it is more difficult. But we had an orientation where leaders like myself who have

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APPLICATIONS DUE MAY 1, 2000 FOR WORKSHOP PROJECT ASSOCIATE GRANTS

In order to disseminate the Workshop Model for Peer-Led Team Learning, the Workshop Project Associate (WPA) program provides funds to assist faculty and learning specialists in developing and implementing a workshop course at their institution.

Eligibility:

Proposals may be submitted for support of Peer-Led Team Learning (PLTL) course development in any field of science and in mathematics.

Proposals are invited from organizations in the United States and its territories: two-year colleges, four-year colleges, and universities. Applicants must show evidence of familiarity with the PLTL model of instruction. This can be demonstrated through attendance at a short course or workshop. Evidence of a mentoring relationship with an experienced PLTL instructor is desirable.

Submission

Proposals must be postmarked by **May 1, 2000**. Applicants will be notified about funding decisions no later than June 1, 1999.

Future deadlines will occur two times per year through academic year 2001-2002. These dates will be posted on the Workshop Project site at <http://www.scicuny.cuny.edu/~chemwksp>.

Five copies of the written proposal must be submitted to the appropriate WPA officer. Proposals for disciplines that do not fit one of the categories below should be submitted to Pratibha Varma-Nelson.

Biological Disciplines

Michael S. Gaines
University of Miami Department of Biology
P.O. Box 249118, Coral Gables, FL 33124-0421
mgaines@umiami.ir.miami.edu – (305) 284-3973

Chemistry (and other disciplines not listed)

Pratibha Varma-Nelson
Saint Xavier University Department of Science
3700 West 103rd Street, Chicago, IL 60655
varmanelson@sxu.edu – (773) 298-3526

Physics and Mathematics

Ronald Narode
Portland State University
Department of Curriculum and Instruction
P.O. Box 751, Portland, OR 97207-0751
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Proposal Preparation

The written proposal should contain the following information, assembled in the order indicated.

1. Cover Sheet

A one-page cover sheet indicating the following:

a) name and postal address of the principal investigator (PI); b) telephone number, fax number, and electronic mail address of PI; c) name and postal address of the organization to which the award should be made; d) discipline under which proposal will be evaluated; e) title of project; and f) requested amount.

2. Project Description

Text in this section of the proposal should be double-spaced and readily legible. Use standard margins, a 12-point font, and print only on one side of the page. Please limit your project description to *no more than five pages*. The description of the project should contain an explicit statement of plans for meeting the critical components of PLTL, including a) description of how the PLTL component of the course will be integrated with other course components; b) description of how the course instructor will be involved with the PLTL component of the course; c) plans for recruitment and training of leaders; d) plans for choice of materials to be used in the course; e) plans for obtaining appropriate organizational arrangements (time, space, group size, etc.); f) evidence of institutional support (such as matching funds for leaders, release time for faculty, recognition for teaching, etc.).

Additionally, the project description should contain: g) description of the course in which the PLTL model will be adapted; h) plans for on-going evaluation (evaluation should utilize evaluation materials already developed by the project, although more extensive plans are welcomed); i) the philosophy of teaching/guiding your implementation; j) description of experience of collaborative/cooperative learning or other curricular revision projects; k) plans for dissemination of your implementation; l) description of contribution from your institution's learning center (if any).

3. Biographical Sketch

Provide a biographical sketch of no more than two pages for the PI. Include items relevant to experience with curricula similar to PLTL and/or curriculum reform.

4. Budget and Budget Justification

Please provide a one-page budget and a one-page budget justification on separate pages. Funding up to \$5000 will be considered. Requests for Workshop leader salaries must be matched on a one-to-one basis from the institution. Acceptable budget categories include (a) workshop leader salaries, (b) support for preparation of materials, (c) travel for dissemination, including the presentation of posters, papers, workshops, or short courses, (d) evaluation, and (e) support for participation of a learning specialist. Indirect or overhead costs are not supported by WPA grants.

Proposal Review Criteria

The general review criteria are consideration of how well the proposal meets the critical components of the Workshop methodology, evidence of understanding the PLTL model, quality of plans, probability of successful implementation, and the other items requested in the project description section. The panel will also consider the qualifications of the personnel submitting the proposal. Reviews are conducted by a panel appointed by the WPA officer for each discipline. Each panelist writes an individual review for all proposals assigned to the panel. The reviews are used by the WPA officers to make final funding decisions.

SUCCEEDING THROUGH MIS-TAKES:

This summer the group of students selecting workshops registered an 85% agreement that "the optional course components I chose reflected the content of the course well." The group that did not select workshops reported 40% agreement.

In the five semesters that I have been here we have done the workshops in five different ways. The good news is that the amplitude of the oscillation — is getting smaller and smaller. We are settling in on a plan, and I think we are real close to a model that is right for Coastal Carolina.

John Goodwin (Chemistry), Brian Gilbert (Chemistry), David Evans (Chemistry Chair), and Lois Ross (Chemistry Lab), faculty members at Coastal Carolina University (Conway, SC), discussed their experiences by phone with Leo Gafney, project evaluator, in early September, 1999. Coastal Carolina University's Chemistry Department received an Adopt & Adapt grant to implement Peer-Led Team Learning. The following is an edited transcription of their conversation.

Leo: *How did you get started with workshops at Coastal Carolina?*

John: In the spring of 1997 I received a local grant to develop a proposal for funding from the Fund for the Improvement of Post-Secondary Education (FIPSE) to improve our General Chemistry program, and we brought together faculty from all of the sciences. We started out thinking that we needed to shift the content, but the pedagogy message came through. I went to a meeting at Stony Brook and learned more about the Workshop Chemistry approach. We started trying to implement it that fall of 1997.

Leo: *What was it that the workshops added to what you had been trying?*

John: When we first started out we were trying to do it gradually, using materials from another university, and we did workshops within the class, without peer leaders. But we decided that didn't work very well because we didn't have time in class, and the materials weren't right, and the groups weren't formed very well. We realized that we needed to make changes pretty quickly.

Leo: *How many are involved in workshops now?*

Brian: We have about 100 students in workshops, with about seventeen student leaders. The professors are John Goodwin and I, and Doug Smith from the School of Education. He is involved in our leader training program.

Leo: *What will that involve?*

Brian: I think it will mostly be covering education aspects such as small group learning. The leader journals are probably going to drive the content of the course itself. We are leaving most of the problems up to the leaders. We have also set up a discussion group on the Internet where the students can post the problems and communicate that way.

Leo: *What materials are you using? How are they working?*

Brian: We are using the *Gosser, Strozak, Craolice* materials. We started using the second semester

materials last year. I think we are happier with the first semester materials than those for the second semester. My feeling is that the first semester materials promote more interaction and discussion.

Leo: *Any other start-up problems?*

Lois: Last year we put the students in workshops according to how they signed up for laboratory classes. There weren't any lecture rooms available so we set up tables and chairs in the hallway, and the safety officers complained every day. We had 24 in a lab, so there were eight students in a group with a peer leader. This was supposed to take an hour and a half of the three-hour lab period and it ended up taking about two hours of the lab. By the time I got into the lab it was pretty hard to get into the experimental material. But it did get students working in groups.

Leo: *Could we back up a little and describe the overall structure of lecture, lab, and workshop?*

Brian: The lecture is a three-credit lecture, meeting three times a week for about an hour. Workshops meet once a week for about an hour and a half. The lab is a one-credit course meeting once a week for three hours. These are completely separated from each other. What we have done is what John likes to call cafeteria style grading.

Leo: *Yes, John mentioned a little about it at Montana but I didn't fully understand it.*

John: The way it is set up, we make two of the components completely optional. One component is the workshop, the other is the computer homework, *skillbuilders*. Students can choose from 0 to 15 percent of their grade for each of those components. Similarly, in-class work, quizzes, tests, and the final exam also have flexible weighting. But they are all required at some minimal level. We have played up the fact that computer homework and workshops can help their grades. This summer the group of students selecting workshops registered an 85% agreement that "the optional course components I chose reflected the content of the course well." The group that did not select workshops reported 40% agreement.

Leo: *About how many have selected the workshops?*

Brian: About 100 students out of 180, so that's close to 60%.

John: That's in our first semester course. I also have a second semester course this fall with about 27 students, and of those 24 have se-

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lected to do workshops. Most have had chemistry with me where workshops were required.

Leo: *How has the response been?*

John: We used the questions in the workshop manual with the second semester course last year and the reception wasn't all that good. And we talked about some of the problems with materials and leader training. But I used the questionnaire with the first semester course in which we made some of these changes and the response was quite good--better than those reported in the workshop guide. I think that as we adopt the critical components and train our leaders better, the program is working better.

Leo: *What are some of the arrangements for working with the leaders?*

Brian: John and I meet with them as part of Doug Smith's education course. We also supply hints for the problems on the Internet. If anyone wants to see it, the address is <http://kingfish.coastal.edu/discus>. Another big change is that last year we graded the workshops based on the answers that we got and this year we are emphasizing that when we grade the workshops we are looking for the work that they do, emphasizing the problem-solving and strategies.

John: We have a specific grading process: 30% of the workshop grade is determined by the workshop leader, whether the student shows up, has done the self test, whether they try to answer questions, and whether they help each other. Another 30% is determined by collecting and checking the completed workshop materials on the exam day. A third component is based on their solution to certain problems given during the workshop that they must do without help from the workshop leader. This review is based more on their reasoning and the information, the kinds of arguments they use.

Leo: *Clearly you have been doing a lot. Do you get good support from your department chair?*

Dave: I hope you will allow me to play administrator for a minute even though I hate to play that role. First, it is not surprising if you do not have a clear picture of what it is we are doing. We don't either. In the five semesters that I have been here we have done the workshops in five different ways. The good news is that the amplitude of the oscillation--I'm an organic chemist--is getting smaller and smaller. We are settling in on a plan, and I think we are real close to a model that is right for Coastal Carolina.

Leo: *So this is all considered important in terms of advancement, promotion, tenure, and things like that?*

Dave: Absolutely. In fact we have cranked it up a notch. Last December on our own time we had a school-wide conference for two days within the School of Natural and Applied Sciences where we had about three-quarters of the faculty participating. We learned about the different learning styles and how they best get information. John and Brian presented and ran a workshop model for our colleagues. We were then asked to huddle up as a department and come back with an action plan for at least one of our courses, to implement next spring, which was last spring. We did that as a department. In fact I think I can say with a clear conscience that our department led the way in the process.

I did an organic course this summer with peer leaders but toward the middle of the term the workshops degenerated into mini-lecture periods. Unfortunately the peer mentors were researchers and had been dragged in to be leaders.

Leo: *Have you been involved with any dissemination activities?*

John: Dave Gosser was invited to give a presentation at Project Kaleidoscope in Washington, DC in late October (1999). And as he usually does he wanted to bring workshop leaders to demonstrate how this works. He has invited me and some of our students from Coastal to come up. Also Brian and I presented a poster at the ACS meeting in New Orleans to talk about what we have been doing for the last two or three years.

Leo: *I am surprised at how many different things you have tried.*

Dave: Frankly, I'm surprised at how many things that we thought would work failed miserably. We really thought that by now we would be closer than we are. This is not a simple process. You really have to look around and talk around and find out what's working. And keep trying, and trying, and trying.

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MODELING AS A LEARNING TOOL: CHEMICAL KINETICS

PLTL sessions open up multiple dimensions in exploring learning materials. One that is particularly suitable for workshops is what can be termed the kinesthetic or haptic dimension, utilizing physical models that involve the sense of touch and that are visual. These examples are not normally accessible through computer animation, which precludes three-dimensional touch. Such models lend themselves to small group exploration, and in the process of manipulating the models, students can obtain an intuitive understanding and feeling for the constraints, interactions, and dynamics of systems that are in many cases difficult, even for experts, to intuit from equations or visual representations alone. The use of physical models has played a significant role in scientific thought and discovery (see Sept 6, 1999, C&EN, "Tetrahedral Carbon Redux," by A. Maureen Rouhi.)

The following is taken from *General Chemistry* (David Gosser, Victor Strozak, and Mark Cracolice) and it has been used as a demonstration workshop many times. Most recently, ten students from Coastal Carolina University and City College of New York, led by David Gosser and John Goodwin, demonstrated it at Project Kaleidoscope Grand Celebration in Washington DC, October 23, 1999.

Workshop on Chemical Kinetics

Work in groups of threes and have one person dedicated to "scorekeeping."

1. Consider a simple chemical reaction, $A \rightarrow B$, that follows a first-order rate law, $\text{rate} = k[A]$. You will model this reaction with pennies. Start with 100 pennies, which will represent the initial concentration of A, 100 mM. Each penny will therefore represent 1 mM.

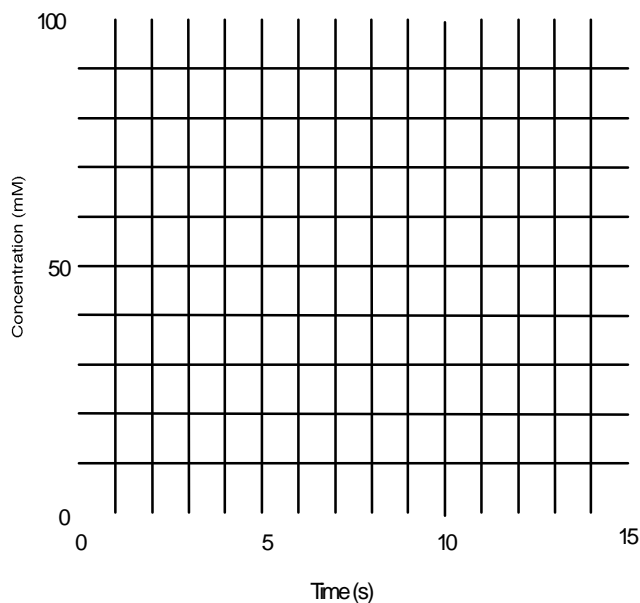
Student A (SA) will represent the concentration of A, and Student B (SB) will represent the concentration of B. We will represent the reaction of A to form B by passing pennies from SA to SB. Each exchange of pennies will represent one second of time. Student C will ask each student for the observed results and record it.

We will model a reaction in which 10% of the concentration of A reacts per second. Thus for each exchange (each second), SA should transfer 10% of his/her pennies to SB. Round fractions to the nearest penny. Continue this exchange for 15 seconds. Record concentrations of A and B (number of pennies)

each second (after each exchange step) in the table below.

Time (s)	[A] (mM)	[B] (mM)
0	100	0
1	90	10
2	81	19
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		

Plot the concentration of A versus time on the graph below. Use a different color to plot the concentration of B versus time on the same graph.



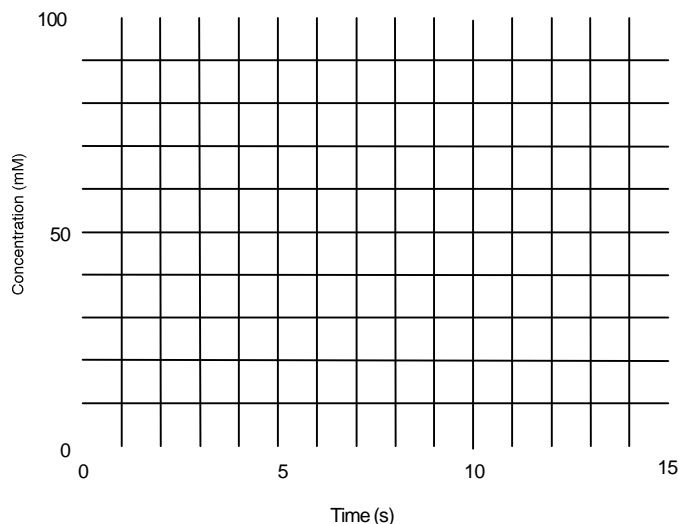
MODELING AS A LEARNING TOOL: CHEMICAL KINETICS

2. Let's apply the modeling technique developed in Question #1 to a reversible reaction, $A \rightleftharpoons B$.

In each second (exchange step), allow 10% of A to react to form B, and allow 10% of B to react to form A. Record the results in the first two columns of table below.

Time (s)	10%	10%
	[A] (mM)	[B] (mM)
0	100	0
1	90	10
2	82	18
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		

Plot the concentration of A versus time for the 10%/10% reaction on the graph below. Compare this graph to the irreversible reaction $A \rightarrow B$, in Question #1.



3. Consider the reversible case, $A \rightleftharpoons B$, in each second (exchange step), allow 10% of A to react to form B, and allow 5% of B to react to form A. Predict the position of equilibrium (i.e. the equilibrium number of pennies). Will A or B be greater? Perform the simulation with pennies to confirm your prediction.

An interesting reference for "glass bead" game types of models can be found in: *Laws of the Game: How the Principles of Chance Govern Nature*. Manfred Eigen and Rithwild Winkler. Princeton Science Library, 1993. (paperback)

PLTL Training at
City College of New York, CUNY

January 12, 2000

Regional Mini-Workshop on PLTL

Contact David Gosser

gosser@scisun.sci.cuny.cuny.edu

January 24-25, 2000

Peer-Leader Training Orientation

Contact Ellen Goldstein

gold3100@con2.com

June 18-20, 2000

Training Peer Leaders

University of Rochester

Rochester, NY

Contact Vicki Roth, Assistant Dean

vrth@mail.rochester.edu

716/275-9049

This conference will bring together faculty, learning specialists, and student leaders to share methods for training undergraduate students to become leaders for peer-led workshops: group dynamics, learning theory, problem solving strategies, content review, and related topics.

REFLECTIONS ON LEADER TRAINING

I was able to learn from my mistakes and correct for them before I led my workshop session.

What we are trying to do is instill students with self sufficiency, giving them the skills they need to think critically and solve problems on their own. Divulging answers only serves to reinforce their reliance on me for those answers...

In an early session of the Workshop Leaders' Training course (at CCNY), held once a week for the student leaders, we did an exercise where we broke up into pairs; one of us was supposed to solve a chemistry problem and the other was supposed to listen (and possibly provide guidance if their partner got stuck). I had always fancied myself a patient person. I believed that I possessed the necessary qualities for being an effective workshop leader; I am genuinely interested in helping people learn, I am passionate about the subject matter, and I know the material. This exercise taught me a valuable lesson to the contrary, and I know that both my workshop students and I have benefited.

We were given a problem that was designed to test our knowledge of the concept of equilibrium. My partner was supposed to solve the problem and I was supposed to be the listener. She gave an answer that I knew to be incorrect. I initially attempted to direct her to the right answer without telling her, suggesting that she look at a certain aspect of her premise which was incorrect. This proved fruitless, and I then told her that she needed to redo part of her answer. This was met with a great deal of resistance. She wanted to stick with her answer and was not interested in alternatives. I could not convince her to come up with another solution, so I told her what I thought the answer should be and why. When the whole group reconvened and discussed the outcome of our exercise, my partner criticized me for being too quick with the answer; I in turn criticized her for not trying hard enough.

Upon reflection I realize that the weight of the situation would have rested almost entirely on me as a workshop leader, in a real classroom situation. I have a hard time keeping my mouth shut when I know the answer and I see someone struggling with it. While I recognize how important it is to not give away answers to the students, the class proved pivotal in making me a more effective educator.

What we are trying to do is instill students with self sufficiency, giving them the skills they need to think critically and solve problems on their own. Divulging answers only serves to reinforce their reliance on me

for those answers and they tend to call me over whenever they are stuck. I also blamed myself for not encouraging my partner properly. I believe it is the job of the workshop leader to cajole reluctant students to participate, to reap the full benefits of the workshop program. To this end the workshop leader must be adept at evaluating the students on a case-by-case basis. Some will respond to the tough-love approach, while others may need to be treated gently and delicately.

The simulation in class allowed me not to make these mistakes: I was able to learn and correct for them before I led my workshop session. Based on student reactions and my own observations, the workshop session went more smoothly than I could have hoped. I was able to tell the students in the very beginning that I was not there to give answers, but to show them how to find them. This attitude initially met with resistance. Many students felt that they had tried the problems and could go no further. With the help of an initial icebreaker where the students introduced each other, I am happy to report that by the end of our initial two-hour session, students were working together quite effectively at solving the problems and not asking for my help.

Our Biology workshop program is a pilot and attendance is not mandatory, so it was encouraging to find that the workshop attendees' average performance on the first exam was above that of the class as a whole.

I believe it is a very important skill for an educator to learn how to properly motivate and captivate the interests of the students on a particular subject matter, but in all fairness it is also the students' job to meet the teacher half way. The workshop program provides a medium where a student is encouraged to go the distance; it serves to bridge the gap between the lecturer and the students, and benefits all involved. In my experience class discussions become more meaningful because the general level of preparedness goes up, the students improve at problem solving, study groups form, motivation and self-reliance are enhanced. The workshop leaders benefit too. Their participation enables them to reinforce the knowledge of the material in their own minds, as well as derive a feeling of self-satisfaction from helping others learn.

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THE 1998 WORKSHOP CHEMISTRY CONSORTIUM'S PROPOSAL TO ADOPT AND ADAPT WORKSHOP CHEMISTRY FUNDED BY NSF

NSF's Division of Undergraduate Education solicited proposals for the Adapt and Adopt emphasis within the Systemic Chemistry Initiative, and funded the following consortium's proposal.

Jerry L. Sarquis, Miami University
 Brian D. Gilbert, Coastal Carolina University
 Robert E. Blake, Jr., Indiana Univ./Purdue Univ.
 Esther J. Gibbs, Goucher College
 Dennis S. Bartow, Prince George's Comm. College
 Garrison B. Lewis, SUNY College of Environmental Science and Forestry
 Charles M. Spuches, SUNY College of Environmental Science and Forestry
 Lucille B. Garmon, State Univ. of West Georgia

A new consortium of seven diverse institutions has been established to adapt and adopt the Workshop Chemistry peer-led team-learning model, which was developed as part of the NSF Initiative for Systemic Changes in the Undergraduate Chemistry Curriculum. This 1998-Workshop Chemistry Consortium (98-WCC) includes Coastal Carolina University (SC), Goucher College (MD), Indiana University/Purdue University at Indianapolis (IN), Prince

George's Community College (MD), State University of West Georgia (GA), and State University of New York College of Environmental Science and Forestry (NY), with Miami University (OH) serving as lead institution. The PI representing each institution has already implemented a pilot Workshop Chemistry program and seeks to expand these efforts to serve larger numbers of students in a variety of courses. The 98-WCC will work closely with the "parent coalition," the PLTL Workshop Project, and the 1997 MACK Workshop Chemistry consortium to refine and extend the Workshop Chemistry model by addressing workshop and laboratory integration, and the use of hands-on activities to serve as the basis of workshop lessons. The 98-WCC will also cooperate with the parent coalition in testing models for peer-leader training, stimulate collaboration between chemistry faculty and learning specialists to improve campus training of workshop leaders, and work with existing projects to evaluate the model and facilitate its use by other institutions.

Coastal Carolina's Workshop site address is
<http://kingfish.coastal.edu/discus>

FACULTY SPREADING THE WORD ON WORKSHOP MODEL

Ron Narode, Portland State University, Department of Curriculum and Instruction, presented on Undergraduate Peer Instruction of Physics at the AAPT/OCEPT meeting October 16, at the University of Oregon, discussing the need for faculty applications for support to develop and implement workshops, to be led by undergraduate workshop leaders who are trained and overseen by faculty. He also described the faculty funding process.

Pratibha Varma-Nelson, Saint Xavier University, Department of Science, will be presenting a seminar on PLTL at Purdue University, Indiana, on December 8, 1999.

Joseph Griswold, City College of New York, Department of Biology, reports that the Workshop Model is being used in Biology 108 (Organismic Biology). The Department has committed to workshops in the four lower level core courses in the core curriculum. In

addition, requests for funding workshops have been included in recent grant applications.

Carl Wamser, Portland State University, Department of Chemistry, reports that there are 13 sections of 5-8 students each for General Chemistry and seven sections of 7-8 each for Organic Chemistry. The new web page is <http://chem.pdx.edu/~wamser/ChemWorkshops/>

Robert Blake, Indiana University/Purdue University, will give the Plenary Lecture at the Conference on Teaching Chemistry to Engineering Students, at the Instituto Polytecnico Nacional (IPN), Mexico City, Mexico, on December 2, 1999. He also presented "The Workshop Chemistry Instructional Model" at the 19th Annual Lilly Conference on College Teaching, at Mi-

Portland State University's Chemistry Workshop site address is
<http://chem.pdx.edu/~wamser/ChemWorkshops>

(Continued on page 13)

WORKSHOP LEADERS' PERSPECTIVES

(Continued from page 4)

done it for a while could give our experience. Then we broke into groups to work out some of the problems in the first set. That way we could see what exactly it feels like, because a lot of us didn't participate in the Chem Excel program. Then he asks: "Did anyone feel awkward? Did anyone find it difficult to participate?" That way we get a sense of how it feels to participate. There are always differences in interest levels; there's always a quieter one or a noisier one— even among the leaders. The leaders are supposedly more interested and want to do the problems. But we had to think about the students. Some of the students taking the course really don't want to be there. Or don't want to be in the group.

Leo: *And do the leaders meet from time to time now that you have begun the course?*

Kevin: Dr. Wilson likes to get the leaders together once a week, especially now that there are so many leaders to share experiences. But he mainly relies on journal entries. He requires all of the leaders to submit journal entries—telling him everything: how they were doing, how they felt their students were doing. And I found it is best if you do it right away, when it is still fresh in your mind.

Leo: *How about the workshops themselves? What would be a typical workshop?*

Kevin: We first obtain the problem sets from Dr. Wilson. We hand out the problems to the

Each leader has his or her own style. I've had to change my style according to the group. I let the group determine what its momentum should be.

In the workshops we want to give them some problems that are a little bit more creative and a little bit more involved (than those in the text).

students. Each leader has his or her own style. I've had to change my style according to the group. I let the group determine what its momentum should be. Some leaders let students congregate in their own groups (within the workshop group). Maybe the faster students would want to work together. Some leaders feel more comfortable being up and about, maybe at the board, being able to lead the whole group as one unit.

Leo: *Do you get the sense that students feel the workshop really complements what they do in the lecture?*

Kevin: Yes, before there were only so many sections of Chem Excel and we would have students from all over, from different lecturers, and some would be ahead of others. But now Dr. Wilson has set it up so that those taking Chem Excel will be in specific sections. And in that regard we are able to have the problem sets correspond to what the students are doing. And sometimes he likes to include problems from old exams.

Leo: *Do students feel that the workshops are helping them in tests and exams?*

Kevin: Yes... in the workshops we want to give them some problems that are a little bit more creative and a little bit more involved (than those in the text). We want to be sure that they are challenging; and if they can at least get the right mind-set for these problems, they can do any problems.

PRENTICE HALL TO PUBLISH WORKSHOP MATERIALS

Prentice Hall is planning to publish a series of Workshop materials. John Challice, Senior Editor, is working closely with members of the Project Consortium to develop marketing strategies. John attended the PLTL Workshop at the Biennial Conference on Chemical Education (BCCE), and recently met to finalize publication schedules. The materials will be available in Spring 2000 and will be under the aegis of Prentice Hall's series in Educational Innovation (EI). The titles are as follows:

The Workshop Model: Peer-Leadership and Learning. A Guidebook: David Gosser, Mark Cracolice, Jack Kampmeier, Vicki Roth,

Victor Strozak and Pratibha Varma-Nelson.

Organic Chemistry: Jack Kampmeier, Pratibha Varma-Nelson, and Donald Wedegaertner.

General, Organic and Biochemistry (GOB): Pratibha Varma-Nelson and Mark Cracolice.

General Chemistry: David Gosser, Victor Strozak, and Mark Cracolice.

A Handbook for Workshop Leaders: Vicki Roth, Ellen Goldstein, and Vivian Snyder.

For more information check the PLTL website.

ROCKY MOUNTAIN CONFERENCE: STRATEGIES ON DISSEMINATION

(Continued from page 1)

Ron Narode of Portland State University presented a model of peer-to-peer paired problem solving, and he also discussed the relationship between the Workshop model, and science and mathematics K-12 teacher training.

A workshop on Workshops, led by Cyrena Bowers, a Workshop leader at The University of Montana, with assistance from two former University of Rochester Workshop leaders, Melissa Glendening (a graduate student at IUPUI) and Amy Diegelman (a postdoctoral student at Penn State), was conducted for attendees who were less experienced with the model. Victor Strozak, now at the Graduate Center of the City University of New York, was the faculty leader of the workshop, and he also managed the breakout groups, which addressed discipline-specific issues related to dissemination.

Highlights of the conference were sessions on the new Workshop Project Associate (WPA) program, the evaluation of dissemination efforts, the elements of peer-leader training, and the institutionalization of the Workshop model. Led by Pratibha Varma-Nelson, conference participants brainstormed ideas for dissemination strategies for the WPA program that were then used by the WPA committee to arrive at a finalized plan. Project evaluator Leo Gafney led a session on the plan for evaluation of peer-led team learning dissemination, based on five overall project goals. He also introduced a new strategy for

quantifying the degree to which the Critical Components of the workshop model are in place at any site. Ellen Goldstein of City College led a session on the identification of common needs and concerns in leader training, the sharing of ideas and resources, and the development of an action plan for peer-leader training dissemination. Dennis Bartow of Prince George's Community College in Maryland and Jack Kampmeier were the co-leaders of the session that focused on institutionalization and dissemination efforts. Conference participants were assigned to groups based on their type of institution, and the similarities and differences of institutional issues amid the variety of types of colleges and universities found in the U.S. were considered within the context of dissemination.

Bookend presentations for the conference were provided by the Principal Investigator of the PLTL Workshop Project, David Gosser. He opened the conference with a discussion of the evolution of peer-led team learning, and then outlined keys for the success of the project. The subsequent overview of proposed dissemination activities segued into a list of goals for the conference itself. He concluded the proceedings with a list of concrete plans for dissemination, one of which is this newsletter.

Rocky Mountain Conferences are to be continuing annual events, held each summer, to strategize about dissemination issues and to develop leadership and scholarship related to peer-led team learning in the sciences and mathematics.

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The similarities and differences of institutional issues amid the variety of types of colleges and universities found in the U.S. were considered within the context of dissemination

FACULTY SPREADING THE WORD ON WORKSHOP MODEL

(Continued from page 11)

ami University, Oxford, OH, on November 19, 1999.

Dennis Bartow, Prince George's Community College, Department of Physical Sciences, will discuss "Institutional Strengthening Program: Active Learning Strategies" at the Lilly Conference on College and University Teaching— Atlantic Region, April 7-9, 2000, Towson, MD, presenting with Dr. R. Hailstorks. He will also present at the Miami 2000 Conference, on April 29-May 2, 2000, on the topic of "WPA

Associates and Deans Implementing PLTL: Barriers to Implementation at Two-Year Colleges."

Madeline Adamczeski, San Jose City College, will participate in the Math and Sciences Teacher Education Program (MASTEP) in June 2000, at San Jose State University. She will be discussing "Preparing Future Science Teachers at San Jose City College Through Peer-led Chemistry Workshops." She presented on this topic at the chemistry sessions for the MASTEP/LACTE Conference on November 12-13, 1999 in San Francisco.

**APRIL 29 -
MAY 2,
2000
IN
MIAMI!
MIAMI
2000
CONFERENCE ON
PLTL**

PROJECT NOTES

(Continued from page 2)

The Workshop Project faculty have developed materials, but the key to the success of the model is not “our” materials, but a creative and faithful interpretation of the Critical Components.

2) *The emotional answer:* The interlinked roles of the students, faculty and learning specialists; working as teams; appreciating the wisdom of teams; and a willingness to provide leadership roles for students.

If we visit our local bookstore's computer section, we are likely to see several titles such as *Delphi Unleashed!* or *Linux Unleashed!* What can unleash students from their traditional role as passive learners? A key to the effective implementation of active learning may be found in the pioneering research of Vygotsky*, in which it is argued that the most effective learning takes place when students are offered assistance in solving challenging problems by more capable peers. In light of this, faculty should consider shifting their role in teaching from being the sole authority and presenter of information to that of a facilitator of peer-assisted learning. An important way this can take place is in the weekly meetings of the faculty and the peer-leaders. This is an excellent opportunity to impact on the quality of the workshops. Not by lecturing to the student leaders(!) but by modeling practical ways to solve problems and understand the content in the context of a small group – a fascinating and open-ended quest. Faculty are freed in unexpected ways: since we no longer have to accomplish every single educational goal within the confines of the lecture, we can approach even lectures in a more creative and personal fashion.

Another change from a typical approach to teaching a PLTL integrated course is the opportunity to collaborate in the design with someone who has specialized expertise in pedagogy and learning theory. This can be especially fruitful, since faculty often have limited training and experience in small group collaborative learning. It is also a case where 1+1>2. Through this collaboration the mutually shared goals of both the faculty and learning specialist, to enhance student learning,

are satisfied beyond what can be accomplished in traditional isolation.

For the peer-leaders the leadership role provides a unique opportunity for personal and professional growth. Working together with the faculty, they prepare for the PLTL workshops. They also provide vital feedback on the success of the workshop materials and methods in actual practice. As peer-leaders, they can form much closer ties with the college and university. They have a positive experience with teaching which can lead to an interest in a career in science/math teaching, a critical national need.

Students and student leaders have played a valuable role in the dissemination of the model. I have been regularly amazed at the eloquence, refreshing candor, and passion with which they embrace the PLTL model. Their presentations have by far been the most compelling at professional conferences and workshops. Some of these have even been breakthroughs at the national level, especially the meetings in which peer-leaders have assisted us by conducting sample workshops where they led interested faculty in a workshop and discussing the details of PLTL with these participants.

All the evaluation results tell us this is true – we can “unleash” the power of students as leaders and participants in courses, by providing them with a well structured but open environment where they are free to make mistakes and learn from, and with the guidance of, their leader and their fellow classmates. Participating PLTL students gradually develop a greater poise and self-confidence in the pursuit of understanding.

But the greatest strength of the PLTL model is that it presents a structure that creates a real sense of community of scholars, where students can realize the ultimate goal of taking responsibility for their own learning.

David K. Gosser, Jr., Project Director
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* Vygotsky, S. (1980). *Mind in Society*. Cambridge: Harvard University Press.

“...the greatest strength of the PLTL model is that it presents a structure that creates a real sense of community of scholars, where students can realize the ultimate goal of taking responsibility for their own learning.”

Faculty are freed in unexpected ways: since we no longer have to accomplish every single educational goal within the confines of the lecture, we can approach even lectures in a more creative and personal fashion.

CHAUTAUQUA SHORT COURSES ON PLTL

The Workshop Project offered the first short course on Peer-Led Team Learning at the Chautauqua Short Course Program in Philadelphia on June 11-13, 1998. The presenters were Pratibha Varma-Nelson, David Gosser, Jack Kampmeier, Vicki Roth, and peer-leaders. The course was attended by twenty-five faculty members; a group from seven different institutions formed a coalition, and submitted a proposal to the National Science Foundation to introduce PLTL in their courses, which was funded (see page 11 for more information).

The course was offered for a second time on June 10-12, 1999. Again joining the presenters were peer leaders, as before drawn from Saint Xavier University, University of Rochester, and City College of New York. Several WPA applications are expected to be gen-

erated from the 32 faculty members in attendance.

On June 15-17, 2000, in Philadelphia, the PLTL course will be offered a third time. Student leaders from several campuses are expected to accompany the faculty presenters. The attendees are expected to come from several disciplines, enlarging the potential number of courses, faculty members, and institutions that plan to adopt the PLTL Workshop model.

For information on registration, contact the Chautauqua Program website, <http://www.engrng.pitt.edu/~chautauq/> For more information on the courses, contact Pratibha Varma-Nelson, via e-mail (varmanelson@sxu.edu).

**CHAUTAUQUA
COURSE ON PLTL**

JUNE 15-17, 2000

**PHILADELPHIA
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REGISTRATION**

**[http://www.
engrng.pitt.edu/
~chautauq/](http://www.engrng.pitt.edu/~chautauq/)**

SPRING 2000

**CHAUTAUQUA
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*For detailed contact
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web site, Project Per-
sonnel Section.*

*If you are making
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PLTL Workshops,
please contact
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(aedreyfuss@aol.com)
so that we can main-
tain an accurate and
current database on
efforts to disseminate
the PLTL model.*

DISSEMINATION GRANT PROJECT LEADERSHIP

Progressions: Peer-Led Team Learning is a quarterly publication of the Workshop Project.

Progressions is intended to build the Workshop community by telling the stories of adoption of the Workshop Model at institutions of learning. It also will provide useful examples of materials that have been successful, and is intended to be a forum for what works in leader training.

The editors are looking for contributions: please contact us with special concerns you would like addressed, have a presentation or workshop to announce, or an article that you believe others would find interesting.

The Workshop Project Newsletter

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Special points of interest in the next issue of *Progressions*:

- Evaluation Strategies
- Vygotsky's Theory
- Report from Portland
- Ask Jack! We did...

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